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harmonize with the phenomena observed in them; and not until then will the time come to frame hypotheses respecting the origin of the abnormal conditions of pressure in their atmospheres.

It is quite possible that, as observations of motions in the line of sight become more and more refined, the conditions of pressure in the atmospheres of the stars can no longer be neglected, although it may be assumed that the pressure in the atmospheric layers from which the light comes to us is neither subject to great variations for any individual star, nor varies widely for different individuals. Even if this should not be true, the means of arriving at accurate results for stellar motion, and at the same time of gaining information concerning the conditions of pressure in the stellar atmospheres, is to be found in the use of different metals for comparison spectra.

THE ORBIT OF *99 HERCULIS*=*A. C.* 15.

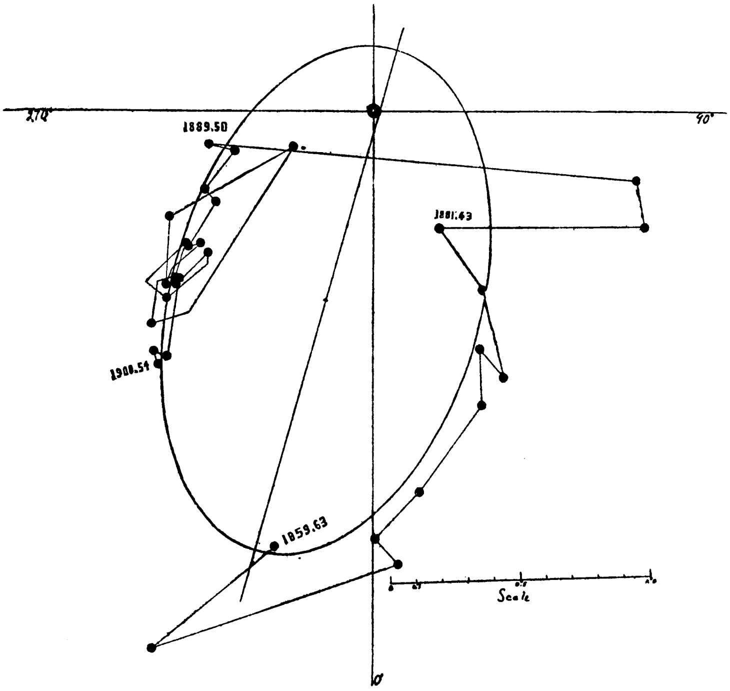
By R. G. Aitken.

The faint companion to *99 Herculis* was discovered by Alvan Clark in 1859, and the first measures of it were secured by Dawes in the same year. Otto Struve measured it on five nights during the next twenty years, but otherwise it was wholly neglected until Burnham began work with the 18½-inch Dearborn refractor in 1878.

The measures indicated motion, but whether this was rectilinear or orbital it was impossible to say until 1889. In that year Burnham observed the pair with the 36-inch telescope of the Lick Observatory, and found that the small star had passed over an arc of more than 180° since his observation in 1881. It was at once evident that the system was binary, with a moderately short period.

In the last ten years the star has been observed frequently, but the great difference in the brightness of the two components, and their small angular separation, make it a difficult object, and the measures are discordant.

The following are all the published observations:—



THE ORBIT OF *99 HERCULIS.*

DATE.	Pos. Angle.	Dist.	*n*.	Observer.	O − C. Δ θ	Δ ρ
1859.63	347°.2	1″.70	2	DAWES......	− 2°.4	− 0″.03
60.30	337 .4	2 .22	1	O. STRUVE...	− 12 .9	+ 0 .50
66.68	3 .1	1 .73	1	“	+ 5 .0	+ 0 .15
68.50	0 .1	1 .63	1	“	− 0 .7	+ 0 .11
72.56	7 .0	1 .46	1	“	− 0 .5	+ 0 .12
77.56	20 .7	1 .19	1	“	+ 1 .3	+ 0 .15
78.46	24 .4	0 .99	3	BURNHAM....	+ 2 .0	+ 0 .01
79.47	26 .5	1 .13	1	“	+ 0 .1	+ 0 .23
80.53	31 .6	0 .80	2	“	+ 0 .5	± 0 .00
81.43	29 .4	0 .51	1	“	− 6 .9	− 0 .22
83.65	75 .4	1 .14	2	O. STRUVE...	...	....
88.54	67 .2	1 .05	1	“	...	....
88.73	Apparently single.		36-inch.	BURNHAM....	....	....
89.50	281 .2	0 .65	1	“	+ 16 .7	+ 0 .22
90.45	285 .1	0 .56	3	“ .	+ 6 .6	+ 0 .03
91.56	294 .4	0 .72	3	“	+ 5 .1	+ 0 .07
92.40	299 .2	0 .70	3	“	+ 4 .0	− 0 .04
94.74	305 .7	0 .88	1	COMSTOCK...	− 0 .7	− 0 .07
95.30	307 .0	0 .84	1	SEE.........	− 1 .3	− 0 .15
95.46	309 .5	1 .04	6	BARNARD....	+ 0 .6	+ 0 .04
95.61	297 .2	0 .89	1	HOUGH......	− 12 .1	− 0 .13
95.65	293 .4	0 .34	2	LEWIS.......	− 16 .0	− 0 .68
95.73	313 .4	....	2–0	MOULTON ...	+ 3 .7	....
95.73	315 .2	1 .18	3–2	SEE.........	+ 5 .5	+ 0 .15
95 80	309 .6	1 .00	3	COMSTOCK...	− 0 .3	− 0 .03
96.62	305 .0	0 .85	2	LEWIS.......	− 7 .3	− 0 .25
96.65	311 .9	1 .07	3	COMSTOCK...	− 0 .5	− 0 .03
96.70	310 .3	0 .84	4–3	AITKEN......	− 2 .3	− 0 .26
97.54	311 .1	1 .00	4	“	− 3 .8	− 0 .15
98.54	310 .4	0 .99	2	LEWIS.......	− 6 .9	− 0 .23
99.29	319 .6	1 .23	2	HUSSEY......	+ 0 .7	− 0 .04
99.34	317 .3	1 .25	3	AITKEN......	− 1 .7	− 0 .02
1900.54	319 .0	1 .27	4	“	− 2 .4	− 0 .06

All the complete observations have been plotted to scale, and are represented in the figure (p. —) by the small black circles. Their order in time is indicated by the broken line. A mere inspection of the figure shows how impossible it is to satisfy all of the observations. Some of the most discordant ones must be entirely neglected. Indeed, it is very doubtful whether the measures by OTTO STRUVE in 1883, and especially those in 1888, refer to the real companion at all. In the latter year the distance was almost certainly as small as 0″.5, and the pair therefore exceedingly difficult. In fact, BURNHAM noted it as single with the 36-inch refractor in that year.

After many trials, the ellipse shown in the figure was adopted as the best that could be drawn at present, and from it the following set of elements was derived:—

$P = 63.0$ years. $\Omega = 154^\circ.7$

$T = 1887.0$ $i = 24.7$

$e = 0.76$ $\lambda = 11.3$

$a = 1''.00$ $n = +5.7143$

How nearly these elements satisfy the observed positions may be seen by examining the two columns of residuals following the names of the observers in the table.

A comparison of the above elements with those previously published by GORE and SEE, seems to indicate that the eccentricity and the major semiaxis of the orbit, and the time of periastron passage are fairly well known. The other elements differ widely, as the following tabulation shows:—

	P	T	e	a	Ω	i	λ
GORE...	53.55	1885.58	0.7928	1''.12	50°.1	38°.6	110°.73
SEE.....	57.5	1887.30	0.806	1 .163	77 .0	35 .5	90 .0
SEE.....	54.5	1887.70	0.781	1 .014	Indeterminate.	0 .0	169 .5*
AITKEN.	63.0	1887.0	0.76	1 .00	154 .7	24 .7	11 .3

* The angle of periastron, as the apparent and real orbits are identical.

The present elements, like the preceding ones, can only be considered as preliminary, and it will be many years before a satisfactory orbit can be computed, for the motion of the small star at present is very slow. A short ephemeris is:—

1901.50	323°.2	1''.38
1902.50	325 .0	1 .43
1903.50	326 .6	1 .47
1904.50	328 .1	1 .51
1905.50	329 .5	1 .55

October, 1900.